In the Claims

Current Status of Claims

1.**(canceled)**
2.**(canceled)**
3.**(canceled)**
4.**(canceled)**
5.**(canceled)**
6.**(canceled)**
7.**(canceled)**
8.**(canceled)**
9.**(canceled)**
10.**(canceled)**
11.**(canceled)**
12.**(canceled)**
13.**(canceled)**

14.**(currently amended)** The ~~GC separation protocol~~ method claim ~~12~~18, wherein an order of the positive ramps and the negative ramps are designed to achieve a desired separation ~~protocol~~ efficiency.

15.**(currently amended)** The ~~GC separation protocol~~ method of claim ~~13~~26, wherein an order of the positive ramps, the negative ramps and the holds are designed to achieve a desired separation ~~protocol~~ efficiency.

16.**(canceled)**

17.**(currently amended)** The ~~GC separation protocol~~ method of claim ~~12~~34, wherein an order of the positive temperature ramps, the negative temperature ramps and the ~~holds~~ hold times are designed to achieve a desired separation ~~protocol~~ efficiency.

18.**(new)** A method for improving separation efficiencies comprising the step of:

providing a gas chromatography (GC) apparatus comprising:

a microwave oven adapted to heat the GC column and including:

a GC column having:

a continuous phase material forming a wall surrounding an interior space for containing a chromatography sample and

a microwave absorbing material contained in the continuous phase material,

a microwave source,

a temperature sensor, and

a microwave source controller adapted to control a microwave power to the microwave oven byt the microwave source and to control a power efficiency of the microwave source,

a coolant source, and

a coolant source controller adapted to control a flow rate of the coolant, and

performing one or a first plurality of positive temperature ramps, where each positive temperature ramp comprises raising a current temperature of the GC column from a lower start temperature or a first plurality of lower start temperatures to a higher stop temperature or a first plurality of higher stop temperatures at a positive controlled rate or at a first plurality of controlled rates, and

performing one or a second plurality of negative temperature ramps, where each negative temperature ramp comprises lowering a current temperature of the GC column from a higher start temperature or a second plurality of higher start temperatures to a lower stop temperature or a second plurality of lower stop temperatures at a negative controlled rate or at a second plurality of controlled rates,

where the negative temperature ramp improves the separation of lower boiling components from higher boiling components or the improve the separation of components having boiling points within a narrow temperature range.

19.(**new**) The method of claim 18, further comprising the steps of:

holding the GC column at each higher stop temperature for a positive ramp hold time and at each lower stop temperature for a negative ramp hold time by supplying a coolant to the GC column and irradiating the GC column with microwave energy under temperature maintaining conditions.

20.(**new**) The method of claim 19, wherein the under temperature maintaining conditions comprises a coolant flow rate at a given coolant temperature coupled with microwave heating under computer control to maintain the GC column at each hold temperature.

21.(**new**) The method of claim 18, wherein at least one lower stop temperature is a subambient temperature.

22.(**new**) The method of claim 18, wherein the coolant is nitrogen and the coolant supply is a liquid nitrogen tank.

23.(**new**) The method of claim 18, wherein the narrow temperature range is 10°C or less, each hold time is from about 0 minutes to about 30 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 300°C/minute.

24.(**new**) The method of claim 18, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.1 minutes to about 20 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 200°C/minute.

25.(**new**) The method of claim 18, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.5 minutes to about 10 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 150°C/minute.

26.(**new**) A method for improving separation efficiencies comprising the step of

providing a gas chromatography (GC) apparatus comprising:

a microwave oven adapted to heat the GC column and including:

a GC column having:

a continuous phase material forming a wall surrounding an interior space for containing a chromatography sample and

a microwave absorbing material contained in the continuous phase material,

a microwave source,

a temperature sensor, and

a microwave source controller adapted to control a microwave power to the microwave oven byt the microwave source and to control a power efficiency of the microwave source,

a coolant source, and

a coolant source controller adapted to control a flow rate of the coolant, and

irradiating the GC column with microwave energy at a controlled irradiation rate sufficient to produce a positive temperature ramp, where a lower start temperature is raised to a higher stop temperature, and

supplying a coolant to the GC column at a controlled rate sufficient to produce a negative temperature ramp, where a higher start temperature is lowered to a lower stop temperature,

where the negative temperature ramp improves the separation of lower boiling components from higher boiling components or the improve the separation of components having boiling points within a narrow temperature range.

27.(**new**) The method of claim 26, further comprising the steps of:

holding the GC column at each higher stop temperature for a positive ramp hold time and at each lower stop temperature for a negative ramp hold time by supplying a coolant to the GC column and irradiating the GC column with microwave energy under temperature maintaining conditions.

28.(**new**) The method of claim 26, wherein the under temperature maintaining conditions comprises a coolant flow rate at a given coolant temperature coupled with microwave heating under computer control to maintain the GC column at each hold temperature.

29.(**new**) The method of claim 26, wherein at least one lower stop temperature is a subambient temperature.

30.(**new**) The method of claim 26, wherein the coolant is nitrogen and the coolant supply is a liquid nitrogen tank.

31.(**new**) The method of claim 26, wherein the narrow temperature range is 10°C or less, each hold time is from about 0 minutes to about 30 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 300°C/minute.

32.(**new**) The method of claim 26, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.1 minutes to about 20 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 200°C/minute.

33.(**new**) The method of claim 26, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.5 minutes to about 10 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 150°C/minute.

34.(**new**) A method for improving separation efficiencies comprising the step of

providing a gas chromatography (GC) apparatus comprising:

a microwave oven adapted to heat the GC column and including:

a GC column having:

a continuous phase material forming a wall surrounding an interior space for containing a chromatography sample and

a microwave absorbing material contained in the continuous phase material,

a microwave source,

a temperature sensor, and

a microwave source controller adapted to control a microwave power to the microwave oven byt the microwave source and to control a power efficiency of the microwave source,

a coolant source, and

a coolant source controller adapted to control a flow rate of the coolant, and

irradiating the GC column with microwave energy at a controlled irradiation rate sufficient to produce a positive temperature ramp, where a lower start temperature is raised to a higher stop temperature,

holding the GC column at the higher stop temperature for a positive ramp hold time by supplying a coolant to the GC column and irradiating the GC column with microwave energy under temperature maintaining conditions,

supplying the coolant to the GC column at a controlled flow rate sufficient to produce a negative temperature ramp, where a higher start temperature is lowered to a lower stop temperature,

holding the GC column at the lower stop temperature for a negative ramp hold time by supplying a coolant to the GC column and irradiating the GC column with microwave energy under temperature maintaining conditions,

where the negative temperature ramp and negative ramp hold time improves the separation of lower boiling components from higher boiling components or the improve the separation of components having boiling points within a narrow temperature range.

35.(**new**) The method of claim 34, wherein the under temperature maintaining conditions comprises a coolant flow rate at a given coolant temperature coupled with microwave heating under computer control to maintain the GC column at each hold temperature.

36.(**new**) The method of claim 34, wherein at least one lower stop temperature is a subambient temperature.

37.(**new**) The method of claim 34, wherein the coolant is nitrogen and the coolant supply is a liquid nitrogen tank.

38.(**new**) The method of claim 34, wherein the narrow temperature range is 10°C or less, each hold time is from about 0 minutes to about 30 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 300°C/minute.

39.(**new**) The method of claim 34, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.1 minutes to about 20 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 200°C/minute.

40.(**new**) The method of claim 34, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.5 minutes to about 10 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 150°C/minute.

41.(**new**) A GC separation protocol method for a microwave heated GC apparatus comprising the steps of:

providing a gas chromatography (GC) apparatus comprising:

a microwave oven adapted to heat the GC column and including:

a GC column having:

a continuous phase material forming a wall surrounding an interior space for containing a chromatography sample and

a microwave absorbing material contained in the continuous phase material,

a microwave source,

a temperature sensor, and

a microwave source controller adapted to control a microwave power to the microwave oven byt the microwave source and to control a power efficiency of the microwave source,

a coolant source, and

a coolant source controller adapted to control a flow rate of the coolant, and

applying at least one positive temperature ramp to the GC column, and

applying at least one negative temperature ramp to the GC column,

where the negative temperature ramp and negative ramp hold time improve the separation of lower boiling components from higher boiling components or the improve the separation of components having boiling points within a narrow temperature range.

42.(**new**) The method of claim 41, further comprising the steps of:

holding the GC column at each higher stop temperature for a positive ramp hold time and at each lower stop temperature for a negative ramp hold time by supplying a coolant to the GC column and irradiating the GC column with microwave energy under temperature maintaining conditions.

43.(**new**) The method of claim 42, wherein the under temperature maintaining conditions comprises a coolant flow rate at a given coolant temperature coupled with microwave heating under computer control to maintain the GC column at each hold temperature.

44.(**new**) The method of claim 41, wherein at least one lower stop temperature is a subambient temperature.

45.(**new**) The method of claim 41, wherein the coolant is nitrogen and the coolant supply is a liquid nitrogen tank.

46.(**new**) The method of claim 41, wherein the narrow temperature range is 10°C or less, each hold time is from about 0 minutes to about 30 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 300°C/minute.

47.(**new**) The method of claim 41, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.1 minutes to about 20 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 200°C/minute.

48.(**new**) The method of claim 41, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.5 minutes to about 10 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 150°C/minute.

49.(**new**) A GC separation protocol method for a microwave heated GC apparatus comprising the steps of:

providing a gas chromatography (GC) apparatus comprising:

a microwave oven adapted to heat the GC column and including:

a GC column having:

a continuous phase material forming a wall surrounding an interior space for containing a chromatography sample and

a microwave absorbing material contained in the continuous phase material,

a microwave source,

a temperature sensor, and

a microwave source controller adapted to control a microwave power to the microwave oven byt the microwave source and to control a power efficiency of the microwave source,

a coolant source, and

a coolant source controller adapted to control a flow rate of the coolant, and

applying one or a plurality of positive temperature ramps to the GC column, where the positive temperature ramps are the same or different,

applying one or a plurality of negative temperature ramps, where the negative temperature ramps are the same or different,

holding a resulting GC column temperatures after each positive or negative temperature ramp for one or a plurality of hold times by supplying a sufficient coolant flow and sufficient microwave energy under temperature maintaining conditions, where the hold times are the same or different, and

where the negative temperature ramps and hold times improve the separation of lower boiling components from higher boiling components or the improve the separation of components having boiling points within a narrow temperature range.

50.(**new**) The method of claim 49, wherein the under temperature maintaining conditions comprises a coolant flow rate at a given coolant temperature coupled with microwave heating under computer control to maintain the GC column at each hold temperature.

51.(**new**) The method of claim 49, wherein at least one lower stop temperature is a subambient temperature.

52.(**new**) The method of claim 49, wherein the coolant is nitrogen and the coolant supply is a liquid nitrogen tank.

53.(**new**) The method of claim 49, wherein the narrow temperature range is 10°C or less, each hold time is from about 0 minutes to about 30 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 300°C/minute.

54.(**new**) The method of claim 49, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.1 minutes to about 20 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 200°C/minute.

55.(**new**) The method of claim 49, wherein the narrow temperature range is 10°C or less, each hold time is from about 0.5 minutes to about 10 minutes, and each positive or negative temperature ramp comprises a heating rate or cooling rate between about 1°C/minutes and about 150°C/minute.